Eastern Illinois University
Revised Course Proposal
CHM 2845, Organic Chemistry Laboratory II

1. Catalog Description

a. CHM 2845
b. Organic Chemistry Laboratory II
c. (0-3-1)
d. Fall, Spring
e. Org Chem Lab II
f. Representative reactions of alcohols, ethers, aldehydes, ketones, amines, carboxylic acids, and carboxylic acid derivatives, employing multi-step syntheses and advanced techniques, with some molecular modeling. Strong emphasis on infrared and nuclear magnetic resonance spectroscopy and gas chromatography/mass spectrometry.
g. CHM 2440, CHM 2445; concurrent enrollment or prior credit in CHM 2840.
h. Fall 2005

2. Student Learning Objectives and Evaluation

a. Learning Objectives

Students will:

- Perform experiments designed to reinforce the concepts taught in CHM 2840.
- Perform multi-step experiments and master standard purification techniques safely.
- Become proficient in understanding the theory behind infrared and nuclear magnetic resonance spectroscopy, as well as mass spectral techniques.
- Become proficient in using spectral techniques to determine the identity and purity of the products from reactions.
- Expand and refine report-writing skills.

b. Evaluation

Final grades will be derived from:

4-8 written laboratory reports	60%
3-5 quizzes/exams, homework assignments	30%
performance grade	10%
(includes proper maintenance of a laboratory notebook, working safely/proficiently in laboratory)	

Evaluation Means / Objective	Written Reports	Quizzes	Homework	Performance Grade
Reinforce concepts from CHM 2840	X	X		
Successfully complete multi-step experiments	X			X
Safely work in laboratory				X

Understanding spectroscopic theory		X	X	
Using spectroscopy for product identity/purity	X	X		
Expand/refine report writing skills	X			

c. n/a

d. n/a

e. This is a writing-intensive course, as detailed laboratory reports are required for each experiment and comments will be made on each report. At least one revision of a laboratory report is required.

3. Course Outline

a. The class will meet for 3 hours each week for 15 weeks, and usually begin with a pre-laboratory lecture each period. The pre-lab lectures will focus on the details of the experiment to be completed as well as the basics of spectroscopy. The remainder of the time will be spent in the laboratory. Students will complete homework assignments on the spectroscopy lectures, write formal laboratory reports for each experiment, and take quizzes/exams covering the experiments as well as the spectroscopic techniques.

A sample proposed course outline is given below:

Week 1 – Course introduction, check-in
Experiment 1 – Diels-Alder
Perform Diels-Alder reaction; Hydrolyze Diels-Alder Adduct

Week 2 – IR Spectroscopy lecture, Homework # 1 Handed out
Analysis of Experiment 1 Products (mp, IR spectra)

Week 3 – Experiment 2 – Cyclohexene oxide (Day 1)
Prepare 2-Bromocyclohexanol from Cyclohexene

Week 4 – Quiz #1
Experiment 2 – Cyclohexene oxide (Day 2)
Prepare Cyclohexene oxide from 2-Bromocyclohexanol

Week 5 – Experiment 2 – Cyclohexene oxide (Day 3)
Prepare Cyclohexene-1,2-diol from Cyclohexene oxide. Analyze products by TLC, IR spectra, mp

Week 6 – NMR lecture #1
Experiment 3 – Aromatic Nitration Reaction (Day1)
Nitration of either methyl benzoate or bromobenzene

Week 7 – NMR lecture #2, Homework #2 Handed out
Experiment 3 – Aromatic Nitration Reaction (Day 2)
molecular modeling, ^{1}*H NMR, IR, TLC analysis of products*

Week 8 – Experiment 4 – N-Methyl Prozac Synthesis (Day 1)
Reduction of 3-(Dimethylamino)-1-propiophenone

Week 9 – Quiz #2
Experiment 4 – N-Methyl Prozac Synthesis (Day 2)
Electrophilic Aromatic Substitution, Preparation of Oxalate Salt of NMP

Week 10 – Experiment 4 – N-Methyl Prozac Synthesis (Day 3)
Analyze products by IR, ^{1}H NMR, mp

Week 11 – GC/MS lecture, Homework # 3 Handed out
Experiment 5 – Fischer Esterification (Day 1)
Preparation of Ester

Week 12 – Experiment 5 – Fischer Esterification (Day 2)
Analyze product by IR, ^{1}H and ^{13}C NMR, GC/MS analysis

Week 13 – Experiment 6 – Optical Resolution (Day 1)
Performing the resolution of phenylsuccinnic acid

Week 14 – Quiz #3
Experiment 6 – Optical Resolution (Day 2)
Obtaining optical rotations of resolved product

Week 15 – Check-out

b. not applicable

4. Rationale

a. The department is undergoing a restructuring of some of the courses for the major, and it was deemed more effective for our majors to emphasize synthetic organic chemistry and spectroscopic product analysis in two portions – a first exposure in CHM 2845, and a second, more in-depth experience in a senior-level course. Currently, the only exposure chemistry majors have to organic laboratory is in the sophomore year sequence (CHM 2445, CHM 2845). We feel the students would be better served to have a senior-level organic laboratory experience, where they could apply their knowledge from their junior/senior level chemistry courses. The students would also have the opportunity to perform more advanced/detailed experiments, given their honed laboratory skills. The senior-level course, tentatively numbered CHM 4895, will replace CHM 4905 Inorganic Chemistry Laboratory, and the emphasis in this course will go from 100% inorganic chemistry (CHM 4905) to 50% inorganic chemistry and 50% organic chemistry (CHM 4895).

Since there will be a senior-level organic laboratory component, and due to the reduction in laboratory time from meeting twice a week to once a week, CHM 2845 (the sophomore-level component) is being reduced to 1 credit hour.

b. Knowledge and skills learned in CHM 2440 (Organic Chemistry I) and CHM 2445 (Organic Chemistry I Laboratory) are essential to this course. Additionally, since the experiments performed in the laboratory (CHM 2845) are chosen to correlate with the lecture topics in CHM 2840, concurrent enrollment or prior credit in CHM 2840 is needed.

c. There are no similar courses.

d. The course is required for the chemistry major and certain Pre-Professional programs in the Health Sciences. (Note that most medical and pharmacy schools require two semesters of organic lecture and organic lab, for a total of 8 credit hours. Thus the reduction in credit hours should not have an adverse impact on the premedical or pre-pharmacy students).

5. Implementation

a. Drs. Black and Treadwell will teach the course.

b. No additional costs.

c. "Introduction to Organic Laboratory Techniques: Small Scale Approach" by D.L. Pavia, G. M. Lampman, G. S. Kriz, R. G. Engel. Harcourt College Publishers, 1998.
"Introduction to Spectroscopy, 3rd edition" by D. L. Pavia, G. S. Kriz, G. M. Lampman. Harcourt College Publishers, 2001.

6. Community College Transfer

A community college course may be judged equivalent to this course.

7. Date approved by the Department of Chemistry curriculum committee: 10/13/2004

8. Date approved by COS Curriculum committee: 10/29/04

9. Date approved by CAA: 11/11/04